

WHAT IS CLAIMED IS:

1. A method of forming a metal-organic film on a substrate, the method comprising;

introducing at least one metal-organic compound into a CVD chamber
via a carrier gas;

(i) introducing a first reactant gas into the CVD chamber for a first period of time wherein the first reactant gas reacts with the metal-organic compound so as to disassociate the metal component from the organic component at a first reaction energy to thereby result in the metal being deposited on the substrate at a first surface mobility to thereby form nucleation sites for the metal-organic film on the substrate;

(ii) introducing a second reactant gas into the CVD chamber for a second period of time wherein the second reactant gas reacts with the metal-organic compound so as to disassociate the metal component from the organic component at a second reaction energy, greater than the first reaction energy to thereby result in the metal components being deposited at a second surface mobility to thereby result in increased agglomeration of the metal component to increase the growth rate of the metal film on the substrate;

(iii) re-introducing the first reactant gas into the CVD chamber for a third period of time, wherein the first reactant gas results in deposition of the metal component into interstitial spaces formed during the increased agglomeration of the metal component on the substrate during introduction of the second reactant gas to thereby improve surface morphology of the metal film;

2. The method of Claim 1, wherein the metal-organic compound comprises at least one conductive component and at least one organic component.

3. The method of Claim 1, wherein positioning the semiconductor device within the chemical vapor deposition chamber comprises positioning a semiconductor wafer having an isolation region with a semiconductor substrate surface therein in the

chemical vapor deposition chamber so that the semiconductor surface may be coated with the conductive layer so as to form an electrode.

4. The method of Claim 1, wherein the metal-organic compound is a precursor gas mixture selected from the group consisting of a platinum-based precursor gas and a rhodium-based precursor gas.

5. The method of Claim 2, wherein the at least one conductive component is bonded to at least one organic group when forming the conductive layer.

6. The method of Claim 1, wherein the metal-organic compound is a precursor gas selected from the group consisting of a Methylcyclopentadienyl Trimethyl Platinum vapor and a Dicarbonyl Cyclopentadienyl Rhodium vapor into the chemical vapor deposition chamber.

7. The method of Claim 1, wherein introducing the first reactant into the chemical vapor deposition chamber comprises introducing the first reactant simultaneously with the conductive precursor gas.

8. The method of Claim 1, wherein introducing the second reactant into the chemical vapor deposition chamber comprises introducing the second reactant simultaneously with the conductive precursor gas.

9. The method of Claim 1, wherein the first reactant is a reducing agent and is selected from the group consisting of H_2 , NH_3 , and H_2O .

10. The method of Claim 1, wherein the second reactant is an oxidizing agent and is selected from the group consisting of N_2O , O_2 , NO , and O_3 .

11. A method of forming a conductive layer on a substrate, the method comprising:

positioning the substrate in a chemical vapor deposition (CVD) chamber;

introducing at least one precursor gas, having a conductive component and an organic component, into the CVD chamber;

introducing a first reactant gas into the chamber so as to disassociate the metal component from the organic component at a first energy so as to result in a first layer of conductive material being formed on the substrate;

5 introducing a second reactant gas into the chamber after introducing the first reactant gas so as to disassociate the metal component from the organic component at a second energy, different than the first energy, so as to result in columnar growths of conductive material from the first layer of conductive material formed on the substrate; and

10 re-introducing the first reactant gas into the chamber so as to planarize the conductive film by filling in gaps between the columnar growths of the conductive material.

12. The method of Claim 11, wherein introducing the precursor gas into the CVD comprises introducing a precursor gas selected from the group consisting of a platinum precursor gas and a rhodium precursor gas.

15 13. The method of Claim 11, wherein introducing the conductive precursor gas into the CVD chamber comprises introducing a conductive precursor gas selected from the group consisting of a Methylcyclopentadienyl Trimethyl Platinum vapor and a Dicarbonyl Cyclopentadienyl Rhodium vapor into the chemical vapor deposition chamber.

20 14. The method of Claim 11, wherein introducing the first reactant into the CVD chamber comprises introducing a reducing reactant into the chamber.

15. The method of Claim 14, wherein introducing the first reactant into the CVD chamber comprises introducing a reactant into the chamber selected from the group consisting of H_2 , NH_3 , and H_2O .

25 16. The method of Claim 11, wherein introducing the second reactant into the CVD chamber comprises introducing an oxidizing reactant into the chamber.

17. The method of Claim 16, wherein introducing the second reactant into the CVD chamber comprises introducing an oxidizing agent selected from the group consisting of N_2O , O_2 , NO and O_3 .

18. A method of forming a conductive structure on a semiconductor substrate, the method comprising:

(i) performing a first metal-organic chemical vapor deposition step using a first chemistry selected to provide more uniform coverage of the semiconductor substrate;

(ii) performing a second metal-organic chemical vapor deposition step using a second chemistry selected to provide for increased columnar growth; and

alternating the acts (i) and (ii) until a conductive structure of a pre-selected thickness is formed on the semiconductor substrate so that the performance of the first metal-organic chemical vapor deposition step decreases gaps and pin holes formed during the performance of the second metal-organic chemical vapor deposition step.

19. The method of Claim 18, wherein the act of performing the first metal-organic chemical vapor deposition step is initially performed so that the first metal-organic chemical vapor deposition step results in the formation of an initial layer on the semiconductor substrate.

20. The method of Claim 18, wherein the first metal-organic chemical vapor deposition step is performed using a chemistry selected so that the resulting deposited metal species has a first surface mobility.

21. The method of Claim 20, wherein the second metal-organic chemical vapor deposition step is performed using a chemistry selected so that the resulting deposited metal species has a second surface mobility greater than the first surface mobility.

22. The method of Claim 18, wherein the act of performing the first metal-organic chemical vapor deposition step comprises using a reducing chemistry.

23. The method of Claim 22, wherein the act of performing the first metal-organic chemical vapor deposition step comprises introducing a metal-organic compound into a CVD chamber in the presence of a reactant selected from the group consisting of H_2 , NH_3 , and H_2O .

5 24. The method of Claim 18, wherein the act of performing the second metal-organic chemical vapor deposition step comprises using an oxidizing chemistry.

25. The method of Claim 24, wherein the act of performing the second metal-organic chemical vapor deposition step comprises introducing a metal-organic compound into a CVD chamber in the presence of a reactant selected from the group consisting of N_2O , O_2 , NO and O_3 .

10 26. The method of Claim 18, wherein the acts (i) and (ii) comprise introducing a platinum and rhodium metal-organic mixture into a CVD chamber in the presence of one or more reactants.

15 27. A system for forming a conductive element on a semiconductor device, the system comprising:

a CVD chamber that receives the semiconductor device;

a conductive precursor gas supply system that provides a conductive precursor gas to the CVD chamber wherein the conductive precursor gas has both conductive components that when deposited on the semiconductor device form the conductive element and organic components which facilitate step coverage of the conductive element over the semiconductor device; and

20 a reactant gas supply system that provides both a first reactant and a second reactant into the chamber so that conductive precursor gas is deposited using both a first chemistry and a second chemistry such that the first chemistry provides more uniform step coverage and the second chemistry provides increased vertical growth of conductive element and the semiconductor substrate.

28. The system of Claim 27, wherein the conductive precursor gas supply system provides a metal-organic gas to the CVD chamber.

29. The system of Claim 28, wherein the conductive precursor gas supply system provides a combination of Methylcyclopentadienyl Trimethyl Platinum gas and a Dicarboxyl Cyclopentadienyl Rhodium gas.

30. The system of Claim 28, wherein the reactant gas supply system provides a first reactant that is comprised of a reducing gas and a second reactant that is comprised of an oxidizing gas.

31. The system of Claim 30, wherein the reactant gas supply provides a hydrogen-based reducing gas and an oxygen-based oxidizing gas.